REMARKS

Claims 1, 5, 6, 8-10, 12-15, 21-25, and 28-30 are pending in this application. Claims 1, 5-6, and 8-10 stand rejected under 35 U.S.C. § 103 as being unpatentable over Papaefstathiou, "Design of a Performance Technology Infrastructure to Support the Construction of Responsive Software," (hereinafter "P"), in view of Woodbury et al., "Performance Modeling and Measurement of RealTime Multiprocessors with Time-Shared Buses" (hereinafter "Woodbury"). Claims 12-15, 21-25, and 28-30 are rejected under 35 U.S.C. § 103 as unpatentable over US Patent Application Number 2003/0208,284 to Stewart (Hereinafter "Stewart") in view of Woodbury.

Claims 1, 5, 6, and 8-10 have been cancelled. New Claims 31-41 have been added. New Claims 31-41 represent the same subject matter as original claims 1, 5, 6, and 8-10 but are added as new claims for clarity and to facilitate review of the limitations recited. Claim 31 is has been written to include the proposed amendments to discussed in the telephone interview with regard to Claim 1. Claims 12, 21, and 24 are amended. No new matter has been added.

RESPONSE TO CLAIM REJECTIONS UNDER 35 U.S.C. § 103

Claims 1, 5, 6, and 8-10 have been cancelled, so the rejection of those claims is now moot. However, New Claims 31-41 have been added to include the some subject matter previously recited in Claims 1, 5, 6, and 8-10 and to include the additional subject matter discussed in the telephone interview with regard to a proposed amendment to Claim 1. To facilitate prosecution, Applicants will address the rejection of Claims 1, 5, 6, and 8-10 in relation to New Claims 31-41 so that Claims 31-41 can proceed to allowance. Claims 12-15, 21-25, and 28-30 stand rejected under 35 U.S.C. § 103 as being anticipated by Stewart in view of Woodbury.

With regard to § 103 rejections, the Examiner bears the initial burden of establishing a *prima facie* case of obviousness. MPEP at § 2142. To reach a proper determination of obviousness under § 103, the examiner must step backward in time and into the shoes worn by the hypothetical "person of ordinary skill in the art" when the invention was unknown and just before it was made. In view of all factual information, the examiner must then make a determination whether the claimed invention "as a whole" would have been obvious at that time to that person. Knowledge of applicant's disclosure must be put aside in reaching this

determination, yet kept in mind in order to determine the "differences," conduct the search and evaluate the "subject matter as a whole" of the invention. The tendency to resort to "hindsight" based upon applicants disclosure is often difficult to avoid due to the very nature of the examination process. However, impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art. *See* MPEP 2142.

Furthermore, the factual inquiries for determining obviousness are summarized as follows:

1. Determine the scope and content of the prior art.
2. Determine the differences between the prior art and the claims at issue.
3. Resolve the level of ordinary skill in the pertinent art.
4. Consider objective evidence present in the application indicative of obviousness or nonobviousness. *Graham v. John Deere Co.*, 383 US 1, 148 USPQ 459 (1966).

Appellants assert that New Claims 31-41 and Claims 12-15, 21-25, and 28-30, should not be rejected under § 103(a) as asserted in the Final Office Action, because the factual inquiry of *Graham* weighs in favor of nonobviousness when the invention is examined as a whole in view of the prior art.

<u>SCOPE AND CONTENT OF THE PRIOR ART</u>

Papaefstathiou (“P”)

P is directed toward designing a performance technology infrastructure (“PTI”) to support the construction of responsive software. See Title. P is also directed toward providing an integration environment for hardware models, workload descriptions, and performance analysis tools. See Abstract. The PTI disclosed in P includes a workload specification library, a model evaluation engine, and an interface to external hardware models. Id. The PTI components interact with XML scripts based on the syntax of predefined schemas that can be extended to include the requirements of new components incorporated into the system. A prototype implementation of a performance prediction tool is also introduced. Id. The prototype includes third party hardware models, a performance specification language, and an analysis tool. Id.

Although P does appear to provide an environment that allows the use of various different hardware models, P does not appear to teach or disclose interfacing between different hardware models. In particular P does not teach or disclose interfacing between model types such as workload prediction models, data analysis models, and optimization models. Rather, P teaches using a predefined workload to analyze a system using different hardware models.

Woodbury

Woodbury is directed toward performance modeling and measurement of real-time multiprocessors with time-shared buses. See Title. Woodbury teaches constructing a closed queuing network model to address workload effects on computer performance for a highly reliable unibus multiprocessor used in real-time control. See Abstract. The purpose in Woodbury is to present the analytic development and experimental justification of a model to study workload effects on performance for a highly reliable multiprocessor with a time-shared system bus used in real-time control. See Woodbury, p. 214, ¶ 1.

Woodbury also does not appear to teach direct compatibility between different model types such as workload prediction models, data analysis models, and optimization models. Rather, Woodbury teaches using a predefined workload to analyze a system using hardware models.

Stewart

Stewart is directed toward providing a modular architecture for optimizing a configuration of a computer system. See Title. Stewart teaches performing optimization in which data is gathered from a computer simulator, rather than from a real and actual computer system, and uses the data to perform numerous optimization iterations for various potential computer system configurations in order to determine which configuration is optimal. See Abstract. The results of the numerous simulations may be compared to determine which computer system configurations are most efficient. Id.

Stewart also does not appear to teach or disclose direct compatibility between different model types such as workload prediction models, data analysis models, and optimization models. Rather, it teaches using a predefined workload to analyze a system using hardware models.

DIFFERENCES BETWEEN THE PRIOR ART AND THE CLAIMS AT ISSUE

Appellants submit that numerous and significant differences exist between the subject matter recited in the claims and the teachings of the prior art.

Claims 12-15

Claims 12-15 are rejected as unpatentable over Stewart in view of Woodbury. The Office Action asserts that Stewart teaches "gathering an identifier for a data and model flow." However, the Office Action provides no evidence or reasoning to support such a conclusion. Applicants submit that Stewart and the prior art generally fails to teach gathering an identifier for a data and model flow. Applicants note that, as described in the specification, an editor for configuring a workload object provides an interface with an identification module that allows a user to enter an identifier for a particular data and model flow. See Pub. App., p. 8, ¶ 101. Applicants respectfully submit that the art of record is silent with regard to the use of a workload object editor that utilizes an identifier for specifying a particular data and model flow.

The Office Action also asserts that Stewart discloses "data collection" in the Abstract and "gathering performance data" in paragraphs 19-21. However, Applicants note that Claim 12 does not merely recite data collection or gathering performance data. Rather, Claim 12 recites "**designating a data collection module** configured to **dynamically populate a measurement object** in response to **a polling inquiry from a modeling module**, the measurement object comprising updated performance data associated with the operation of a computer system, **the computer system comprising at least one physical processor and physical storage**, the computer system executing a plurality of computing workloads." Stewart appears to be silent with regard to these elements.

For example, Stewart does not appear to teach "designating a data collection module." As described in the present application, various different types of data collection modules may be specified such as user-defined data collection modules or predefined data collection modules. See Pub. App., p. 4, ¶¶ 61-62. The editor claimed in Claim 12 provides an interface that allows broad interoperability between various data collection methods, models, and parameters.

Conversely, Stewart is directed solely toward exchanging types of optimizers and is unconcerned with methods of data collection or providing an interface or framework for specifying different types of data collection modules. Such teachings are also lacking in Woodbury which is directed toward justifying the use of a particular hardware model of a computer system.

The Office Action does acknowledge that Stewart does not explicitly disclose "dynamically populating the data through polling of a computer system." However, the Office Action concludes that this distinction lies only in that Stewart utilizes data gathered from a simulated system, rather than an actual computer system (Woodbury is relied on to teach this element). While it is true that Stewart teaches only data collection from hardware simulations rather than actual computer systems, other distinctions are evident in Claim 12. For example, both Stewart and Woodbury appear to be silent with regard to receiving a "polling inquiry **from** a modeling module." This is likely due to the fact that neither Stewart nor Woodbury teach a modeling module as recited in Claim 12. Claim 12 has been amended to further clarify the distinction between the modeling module recited in Claim 12 and the prior art.

Amended Claim 12 states "wherein **the modeling module designates a workload prediction model, a performance analysis model, and an optimization model** that use the updated performance data wherein the modeling module is further configured such that **output data from a first model serves as input data for a second model in a hierarchy of models**." As disclosed in the specification, a workload prediction model is a tool that forecasts a future load of a system, typically based on current and historical workloads. See Pub. App., p. 1, ¶ 10 and 14. For example, time-series models such as a Box-Jenkins model may be used to predict future workloads. A performance analysis model collects and analyzes information about the performance of a computer system, and an optimization model reviews historical performance information and what-if information to provide suggestions for changes to increase system efficiency. Id. at ¶¶ 11-12. Claim 12 recites an editor with a modeling module that allows a data and model flow to be defined with a framework for specifying each of a different type of workload prediction model, performance analysis model, and optimization model. Furthermore, the editor allows the output of one of these models to act as input to another. Such a modeling

module that allows specification and interoperability of these different types of modeling cannot be found in Stewart, Woodbury, or the prior art generally.

Furthermore, by utilizing a modeling module to send polling inquiries to a real computer system, future workloads and future performance can be anticipated and determined in real-time, thereby allowing for on-the-fly reconfigurations and improvements to the system.

The Office Action also asserts that Stewart teaches the element in Claim 12 of "utilizing a metric map for defining model variables required to analyze analysis data compiled from the plurality of models." The Office Action provides no support or explanation for this assertion. Both Stewart and Woodbury are silent with regard to the use of a metric map for defining model variables. Applicants note that the Examiner has the burden to establish a *prima facie* case of obviousness and submit that a *prima facie* case has not been established in this instance.

Claim 12 also recites "utilizing a plot module for designating a data analysis module configured to present analysis data compiled from the plurality of models." The Office Action admits that Stewart and Woodbury both fail to disclose a plot module; however, the Office Action summarily concludes that it would have been obvious to one of ordinary skill in the art to graphically plot the result data provided by Stewart in order to allow for user simplicity. However, Applicants note that Claim 12 is not merely reciting the graphical plotting of result data, it is reciting **a plot module for designating a data analysis module** configured to present analysis data compiled from the plurality of models. Again, Claim 12 is directed toward an editor that allows selection of various different combinations of data flow and model flows as well as data presentation. Applicants submit that there is no support or evidence in the prior art references, or provided in the Office Action to support a conclusion that a plot module as recited in Claim 12 would be obvious to one of skill in the art.

Therefore, in view of the many elements recited in Claim 12 that are lacking in the combination of Stewart and Woodbury, Applicants respectfully submit that a *prima facie* case of obviousness has not been established with regard to Claim 12 and request that the rejection of Claim 12 be withdrawn. Applicants further request that the rejection of Claims 13-15 be withdrawn as well for the same reasons described above with regard to independent Claim 12.

Claims 21-25 and 28-30

Claims 21-25 and 28-30 are rejected as unpatentable over Stewart in view of Woodbury. Each of Claims 21-25 and 28-30 include at least some subject matter recited in Claim 12, that as explained above, is not found in the prior art of record. Claims 21-23 each recite “utilizing a measurement software class configured to dynamically populate a measurement object in response to a polling inquiry from an instance of a run-time manager software class” and “utilizing a workload software class that defines a data and model flow associated with the computer system, the workload software class comprising a workload prediction model software class, a performance analysis model software class, and an optimization model software class.”

Claims 24-25 each recite “dynamically populating a measurement object in response to a polling inquiry from a modeling module” and “executing a plurality of models comprising a workload prediction model, a performance analysis model, and an optimization model that use the gathered performance data wherein the modeling module is further configured such that output data from a first model serves as input data for a second model in a hierarchy of models.”

Claims 28-30 each recite “specifying a data and model flow for monitoring a computer system,” “invoking a modeling and analysis utility, wherein the data and model flow defines performance data that is dynamically populated in a measurement object in response to a polling inquiry from a modeling module,” and “receiving a real-time graphical representation of the analysis data from the modeling and analysis utility, in response to an event.”

As discussed above, these Claim elements are not taught in the combination of Stewart and Woodbury. Therefore, Applicants respectfully request that the rejection of Claims 21-25 and 28-30 be withdrawn for the reasons stated above with regard to Claim 12.

Claims 31-41

Claims 31-41 are new Claims. However, Claims 31-41 include subject matter that was previously recited in now cancelled Claims 1, 5, 6, and 8-10 with some additional subject matter as discussed in the telephone interview. Claims 1, 5, 6, and 8-10 were rejected as unpatentable over P in view Woodbury. Applicants respectfully submit that Claims 31-41 are in condition to overcome the prior art of P and Woodbury as discussed in the telephone interview.

Claim 31 recites specifying a data and model flow within a framework for analyzing the performance of a computer system by "selecting **a workload prediction model** configured to generate a forecasted workload, the forecasted workload **configured by the framework to serve as input to a model specified in the data and model flow**, **a performance analysis model** configured to generate performance information and configured to monitor and analyze the computer system's performance based on a workload, the performance information **configured by the framework to serve as input to models specified for the data and model flow**, and **an optimization model** configured to generate computer system configuration changes based on a workload, the computer system configuration changes **configured by the framework to serve as input to models specified for the data and model flow for the computer system**." Support for these elements of Claim 31 can be found in the published application at page 1, paragraphs 10-19; page 4, paragraphs 53-56; and page 5, paragraphs 65-67.

Claim 31 further recites "executing the **selected models within the framework** wherein output data from at least one of the selected models is **configured by the framework to serve as input data to at least one other selected model**." Support for this element can be found in the published application at page 5, paragraph 66.

The Office Action asserts that P teaches "specifying a data and model flow" by selecting at least two models at page 98, Table 1. As discussed in the telephone interview, Applicants note that the models disclosed in P are solely hardware models for use in simulating hardware devices and the like. Therefore, Applicants have specified by amendment the selection of a **workload prediction model**, a **performance analysis model**, and an **optimization model**, each of which is configured **by the framework** to serve as input to models specified for the data and model flow for the computer system. Applicants submit that P and the prior art generally fails to teach a framework where a data and model flow can be specified that includes each of a workload prediction model, a performance analysis model, and an optimization model in the manner recited in Claim 31, where the framework enables interoperability between the models such that the input of one model serves as the input of another model.

In the telephone interview, the Examiner agreed that P did not appear to teach these elements and agreed to give these elements close examination in the next response. Applicants

note, as discussed in the telephone interview and defined in Claim 31, that a workload prediction model and an optimization model are not models of hardware devices, but are models such as time-series models (load prediction) which can be used to predict a future load based on a load history or to recommend system configuration changes based on performance analysis (optimization).

The present invention allows for the specification of various different model types and provides a framework to enable compatibility between the models so that the output of one can be used as input to another. For example, the output of a load prediction model could be used as input to a performance analysis model. P, Woodbury, and Stewart each appear to teach the use of predefined workload that is provided to a hardware model for simulation. But none of the references appear to teach a framework that allows the results of a workload prediction model to be fed directly as input to a performance analysis model or an optimization model. The subject matter of Claim 31 allows such interoperability not before available in the art of record.

Claim 31 also recites "specifying an order in which the models are to be executed." The Office Action states that this element is taught on page 99, Top Left, "ordering dependencies." However, the cited portion in P is referring to resolving ordering dependencies in the construction of an events list. For example, the order dependencies disclosed in P refer to predicting the time for a communication, the traffic on the inter-connection network etc. as used in the simulation of a hardware model. Conversely, Claim 31 recites specifying an order of models such as a workload prediction model, a performance analysis model, and an optimization model.

Finally, Claim 31 recites "presenting analysis data **compiled from the execution of the selected models**, the **framework configured to manage** the gathering of performance data, the execution of the selected models, and the presentation of the of the analysis data." Applicants do not argue that the presentation of analysis data is unknown in the prior art. Rather, the presentation of data **compiled from the execution of models** (specified in data and model flow) and a framework configured to manage each of gathering performance data, execution of selected models, and presentation of the analysis data is not taught in the prior art including P and Woodbury.

Therefore, in view of these distinctions between Claim 31 and the prior art of record, Applicants respectfully submit that new Claim 31 is in condition to overcome the prior art of record.

Applicants submit that dependent Claims 32-41 are also in condition to overcome the prior art of record as depending from Claim 31. Applicants further submit that each of Claims 32-41 includes additional subject matter that further distinguishes the present invention from the prior art.

For example, Claim 32 recites "specifying one of a predefined data collection module and a user defined data collection module that collects performance data about the computer system." Support for Claim 32 can be found in the published application at page 4, paragraphs 61-63. Neither P nor Woodbury makes any distinction between a predefined data collection module and a user defined data collection module. Rather P and Woodbury appear to rely on some default data gathering mechanism to collect data. As noted above, the present invention provides a framework that allows interoperability between various different data collection modules, models, and results presentation modules. The prior art appears to be silent in this regard.

Claim 33 recites "wherein at least one of the workload prediction model, performance analysis model, and optimization models is a user defined modeled." Support for Claim 33 can be found in the published application at page 5, paragraph 67. The framework recited in Claim 31 allows for the use of user defined models which enables greater flexibility and functionality in the analysis of computer systems. P and Woodbury appear to be silent with regard to user defined models.

Claim 34 recites "wherein the selected workload prediction model is a time series model." Support for Claim 34 can be found in the published application at page 4, paragraph 56. The prior art including P and Woodbury appear to be silent with regard to the use of a time series model as a workload prediction model.

Claim 35 recites "wherein the selected performance analysis model is a queuing system model." Support for Claim 35 can be found in the published application at page 4, paragraph 56. The prior art including P and Woodbury appear to be silent with regard to the use of a queuing system model as a performance analysis model.

Claim 36 recites "wherein the framework is configured to make the output of the time series model compatible as an input to the queuing system model." Support for Claim 36 can be found in the published application at page 4, paragraph 53. The prior art including P and Woodbury appear to be silent with regard to the use of a framework to make the output of a time series model compatible as an input to the queuing system model.

Claims 37-41 recite substantially the same subject matter as was previously recited in Claims 5, 6, and 8-10.

RESOLVE THE LEVEL OF ORDINARY SKILL IN THE PERTINENT ART

The person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. Factors that may be considered in determining the level of ordinary skill in the art may include: (A) "type of problems encountered in the art;" (B) "prior art solutions to those problems;" (C) "rapidity with which innovations are made;" (D) "sophistication of the technology; and" (E) "educational level of active workers in the field. In a given case, every factor may not be present, and one or more factors may predominate."*In re GPAC*, 57 F.3d 1573, 1579, 35 USPQ2d 1116, 1121 (Fed. Cir. 1995); *Custom Accessories, Inc. v. Jeffrey-Allan Industries, Inc.*, 807 F.2d 955, 962, 1 USPQ2d 1196, 1201 (Fed. Cir. 1986); *Environmental Designs, Ltd. V. Union Oil Co.*, 713 F.2d 693, 696, 218 USPQ 865, 868 (Fed. Cir. 1983).

As stated in the MPEP, the "hypothetical 'person having ordinary skill in the art' to which the claimed subject matter pertains would, of necessity have the capability of understanding the scientific and engineering principles applicable to the pertinent art." *Ex parte Hiyamizu*, 10 USPQ2d 1393, 1394 (Bd. Pat. App. & Inter. 1988) (The Board disagreed with the examiner's definition of one of ordinary skill in the art (a doctorate level engineer or scientist working at least 40 hours per week in semiconductor research or development), finding that the hypothetical person is not definable by way of credentials, and that the evidence in the application did not support the conclusion that such a person would require a doctorate or equivalent knowledge in science or engineering.); MPEP 2141.03.

Here, one of skill in the art is one who is has the capability of understanding the scientific and engineering principles associated with software programming and computer system modeling. In particular, one of skill in the art is one who understands the difference between types of models such as workload prediction models, performance analysis models, and optimization models, and who understands the difficulty of creating compatibility between different model types.

<u>OBJECTIVE EVIDENCE OF NON-OBVIOUSNESS</u>

The objective evidence in this case weighs heavily in favor of a finding of non-obvious with regard to present invention. First as noted above, the differences between the recited claims and the prior art significant. As explained above, each of Claims 12-15, 21-25, 28-30, and 31-41 recite elements that are not taught in the prior art of record and have not been shown to be obvious to one of skill in the art. Therefore, the Office Action fails to make a *prima facie* case of obviousness with regard to the pending claims. Further, the MPEP states that "if the examiner does not produce a *prima facie* case, the applicant is under no obligation to submit evidence of nonobviousness." See MPEP 2142. The Federal Circuit has stated that "rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006).

Nonetheless, even if the combination of cited references is construed as teaching or making obvious every element of the pending claims, the evidence still suggests that such a combination would not be obvious. With regard to the combination of Stewart and Woodbury, the Office Action states that it would have been obvious to one of ordinary skill to "gather data from an actual system in real-time, as discussed in Woodbury, for the analysis in Stewart in order to monitor an actual system as it runs." However, such a combination would render Stewart inoperable for its intended purpose. As decided by the Federal Circuit, if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

In this case, Stewart is directed toward an optimizer that "simulates a cluster of machines running a given workload." See Stewart Abstract. However, one of the intended purposes of Stewart is provide an interface "plugging" in various optimization modules with various different simulators through a simulator interface module. Id. Further the optimization process in Stewart utilizes multiple iterations of simulations to compare performance and determine an optimal solution. Id. To modify Stewart in the manner suggested by the Office Action would render Stewart unsatisfactory for its intended purpose of interfaces simulators with optimizers. Therefore, such a modification would be non-obvious.

With regard to the combination of P and Woodbury, the Office Action states that it would have been obvious to "gather data from an actual system in real-time, as discussed in Woodbury, for the analysis in P in order to monitor an actual system as it runs." However, the intended purpose of P is to design a performance technology infrastructure to support the construction of responsive software by using hardware models to simulate hardware. See Abstract. In other words, the intended purpose of P is to enable the testing of software on simulated hardware models during development, so that the lengthy process of testing the software on actual hardware can be avoided. See P, p. 96, Right Column. As stated on page 97, paragraph 2, P "aims to promote the utilization of model technology during the execution of the application running on distributed systems." The intended purpose of P would be rendered inoperable if P was modified by Woodbury in the manner suggested in the Office Action. Therefore, Applicants submit that such a combination would be non-obvious.

CONCLUSION

As a result of the presented amendments and remarks, Applicant asserts that Claims 12-15, 21-25, 28-30, and 31-41 are patentable and in condition for prompt allowance. Should additional information be required, the Examiner is respectfully asked to notify Applicants of such need. If any impediments to the prompt allowance of the claims can be resolved by a telephone conversation, the Examiner is respectfully requested to contact the undersigned.

Respectfully submitted,

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